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NIOSH national survey of long-haul truck drivers: Injury and safety

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Abstract

Approximately 1,701,500 people were employed as heavy and tractor-trailer truck drivers in the United States in 2012. The majority of them were long-haul truck drivers (LHTDs). There are limited data on occupational injury and safety in LHTDs, which prompted a targeted national survey. The National Institute of Occupational Safety and Health conducted a nationally representative survey of 1265 LHTDs at 32 truck stops across the contiguous United States in 2010. Data were collected on truck crashes, near misses, moving violations, work-related injuries, work environment, safety climate, driver training, job satisfaction, and driving behaviors. Results suggested that an estimated 2.6% of LHTDs reported a truck crash in 2010, 35% reported at least one crash while working as an LHTD, 24% reported at least one near miss in the previous 7 days, 17% reported at least one moving violation ticket and 4.7% reported a non-crash injury involving days away from work in the previous 12 months. The majority (68%) of non-crash injuries among company drivers were not reported to employers. An estimate of 73% of LHTDs (16% often and 58% sometimes) perceived their delivery schedules unrealistically tight; 24% often continued driving despite fatigue, bad weather, or heavy traffic because they needed to deliver or pick up a load at a given time; 4.5% often drove 10 miles per hours or more over the speed limit; 6.0% never wore a seatbelt; 36% were often frustrated by other drivers on the road; 35% often had to wait for access to a loading dock; 37% reported being noncompliant with hours-of-service rules (10% often and 27% sometimes); 38% of LHTDs perceived their entry-level training inadequate; and 15% did not feel that safety of workers was a high priority with their management. This

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survey brings to light a number of important safety issues for further research and interventions, e.g., high prevalence of truck crashes, injury underreporting, unrealistically tight delivery schedules, noncompliance with hours-of-service rules, and inadequate entry-level training.

Keywords

Long-haul truck driver; Truck driver safety; Truck driver injury; Risk factor; Survey; Hours of service

1. Introduction

According to the Bureau of Labor Statistics (BLS), approximately 1,701,500 people were employed as heavy and tractor-trailer truck drivers in the United States in 2012 (BLS, 2014a). The majority of these drivers were over-the-road or long-haul truck drivers (LHTDs), meaning they delivered goods over intercity routes that may span several states (BLS, 2014a). Heavy and tractor-trailer truck drivers were 12 times more likely to die on the job and 3 times more likely to suffer an injury involving days away from work than the U.S. general worker population (Chen et al., 2014; BLS, 2014b). In 2012, 695 heavy and tractor-trailer truck drivers died on the job, the largest number of work-related fatalities in a single occupation. The majority (488/695 or 70%) of these fatalities were caused by motor vehicle crashes. Truck driver safety is not only a national occupational safety priority (NIOSH, 2009) but also a general public health concern because of the high death toll of truck crashes among both drivers and occupants of other vehicles and the economic burden of truck crashes on society. In 2012, there were 3464 large trucks that were involved in fatal crashes, 73,000 were involved in injury crashes, and 241,000 were involved in property-damage-only crashes (FMCSA, 2014a). In the aggregate, for each large-truck driver death, six other persons (persons in other vehicles, pedestrians, or cyclists) died in truck crashes (FMCSA, 2014b). Motor vehicle crashes involving large trucks and buses cost the U.S. economy an estimated $99 billion in 2012 (FMCSA, 2014a). The cost included productivity losses, property damage, medical costs, rehabilitation costs, travel delay, legal and court costs, emergency services (such as medical, police, and fire services), insurance administration costs, and the costs to employers (Blincoe et al., 2002).

Most of the existing studies of commercial truck driver safety in industrialized nations have focused on the risk of roadway truck crashes. These studies suggest an array of factors may increase the risk of roadway truck crashes. These risk factors can be grouped into individual differences, work environment, and safety climate. Individual risk factors may include age, sleep apnea, fatigue, distracted driving, speeding, and number of moving violation tickets received in the previous 12 months, etc. (Bunn et al., 2005, 2009; Bunn et al., 2012, 2013; Apostolopoulos et al., 2010; ATRI, 2011; FMCSA, 2007, 2012a; Sabbagh-Ehrlich et al., 2005; Bigelow et al., 2012; Heaton et al., 2008; Brodie et al., 2009). Work environmental risk factors may include long work hours, tight delivery schedule, being paid by-the-mile/kilometer, road and traffic conditions (Belzer, 2012; Belzer et al., 2002; Stevenson et al., 2010; Quinlan and Wright, 2008; Birdsey et al., 2010; Hanowski et al., 2007, 2009; Chen and Chen, 2011; Khorashadi et al., 2005). Truck drivers can be influenced by the pressures, beliefs, instructions, and safety policies of the company in which they work. The company

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safety climate could have an influence on their driving behaviors (Zohar, 2010; Boyle et al., 2010; Brady et al., 2009; Chen et al., 2015; NIOSH, 2007). Unsafe driving behaviors are the risk factors for motor vehicle crashes (ATRI, 2011; NHTSA, 2014; AAA Foundation for Traffic Safety, 2015; CDC, 2015).

Truck drivers are a mobile and difficult to reach population because they are on the road away from home most of the time. As a result, the majority of previous studies of LHTD safety were often on a small scale, used a convenience sample (Chen and Chen, 2011; Bunn et al., 2013; Khorashadi et al., 2005; Stevenson et al., 2010), examined one or a few risk factors at a time (ATRI, 2011), or included only a subgroup of LHTDs (e.g., independent owner operators or company drivers) (Birdsey et al., 2010). Results from these studies were thus often not generalizable to all LHTDs in the United States.

In 2010, the National Institute for Occupational Safety and Health (NIOSH) conducted the National Survey of LHTD Health and Injury (Sieber et al., 2014). The objective of the NIOSH survey was to assess the prevalence of selected health outcomes and injuries from a nationally representative sample of U.S. LHTDs. While results from the health component of the survey and the survey methodology were reported in Sieber et al. (2014), this paper presents the descriptive analysis showing results of the injury and safety component of the NIOSH LHTD survey. More in-depth analysis of the survey data is forthcoming. The goal of this paper is to provide descriptive data on truck crashes, work-related injuries, work environments, safety climate, driver training job satisfaction, and driving behaviors among U.S. LHTDs.

2. Methods

2.1. Survey methods and study population

The NIOSH survey was a cross-sectional, personal interview of LHTDs at 32 truck stops along select interstate highways across the contiguous United States in October to December 2010. A complex three-stage sampling process was used to achieve a best possible nationally representative sample of LHTDs: (1) a selection of interstate or other limited-access highway sections, (2) a selection of individual truck stops along the selected highway sections, and (3) a selection of drivers for interview at the selected truck stops.

LHTDs were eligible for the survey if they had driven a truck with three or more axles as their main job for at least 12 months and took at least one mandatory 10-h rest period away from home during each delivery run. Eligible drivers were asked to participate in the survey and provided informed consent. If eligible drivers were not willing or unable to participate in the full-length interview due to time or other constraints, they were asked to participate in a short non-respondent interview that collected basic demographic information. As a result of the data collection, 1265 LHTDs completed the full interview. Details of the sampling design, survey administration, data collection, and response rate can be found in Sieber et al. (2014).

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2.2. Questionnaire development

In the development of the survey instrument, a stakeholder meeting was conducted to solicit input. Participants in the stakeholder meeting included representatives from the trucking industry, Owner Operator Independent Drivers Association, unions, Federal Motor Carrier Safety Administration (FMCSA), academia, and other truck and roadway safety organizations. The injury questionnaire was designed to collect date on roadway safety, work-related injuries (truck crash injuries and non-crash injuries), work environment, safety culture, drivers' opinions on their training, and drivers' attitudes. Truck driver demographic and employment history questions were adapted from Belman and Monaco (2004). The draft questionnaire was reviewed by truck safety and survey design experts from academia and governmental agencies. Two cognitive tests and one pretest were conducted with LHTDs to evaluate the questionnaire and survey administration. The survey was approved by both the Office of Management and Budget (OMB no. 0920-0865) and the NIOSH Human Subjects Review Board. The questionnaire is available from the authors upon request.

2.3. Measures of injury and safety

Three roadway safety outcomes were measured: (1) number of Department of Transportation (DOT) recordable truck crashes since working as a LHTD and in what calendar year the first and the most recent crash occurred. A DOT recordable crash is a truck crash on a public road in intrastate or interstate commerce that resulted in a fatality, an injury to a person requiring immediate treatment away from the scene of the accident, or disabling damage to a vehicle, requiring it to be towed (FMCSA, 2013). In this study, two truck crash totals were tabulated, the number of crashes in 2010 and the cumulative number of crashes since working as a LHTD. (2) Number of a near miss in the previous 7 days. A near miss was defined as an incident on a public road that made the truck driver feel lucky not to have been in a crash while driving a truck at work. (3) Number of moving violation tickets in the previous 12 months.

Truck crash injuries and work-related non-crash injuries were collected separately. A truck crash injury was defined as an injury caused by a truck crash which required immediate medical attention by a doctor, nurse, paramedic, or other health professional. The truck crash injury data were restricted to those occurred in the most recent crash. A non-crash injury was defined as a work-related injury which required the worker to visit a doctor or other health professional. Non-crash injuries were restricted to those that occurred in the previous 12 months. The definition of lost work day injury was adapted from the BLS Survey of Occupational Injuries and Illness (BLS, 2014c).

Work environment was examined by using the following questions: hours worked in the past 7 days, miles driven in the past 12 months, delivery schedule, traffic congestion, loading dock waiting, work compensation methods (paid by-the-miles or by-the-hours). Safety climate questions were adopted from the NIOSH Quality of Worklife questionnaire (NIOSH, 2002). Safety climate data were only collected from drivers who worked or contracted for a company.

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To assess the status of truck driver training, data were collected on drivers' opinions on the training they received at the beginning of their career and at the time of the survey was conducted. To examine driver attitudes, questions were asked on truck drivers' frustrations by other drivers on the road and operations on the loading dock. Truck drivers were also asked whether they felt their work was adequately rewarded. To examine driving behaviors, questions were asked on frequency of seatbelt wearing, frequency of speeding, frequency of hours-of-service (HOS) regulations noncompliance, and how often they continued driving despite fatigue, bad weather, or heavy traffic because they must deliver or pick up a load at a given time.

2.4. Statistical analysis

Each completed interview had an associated probability weight representing the inverse of combined probabilities of selection in each of the three sampling stages and a non-response adjustment. The national estimates of the total number of LHTDs and percentages of drivers responding to individual interview questions were determined as the sum of the probability weights for responding truck drivers. Variances of the national estimates were calculated using the jackknife replication method for complex survey data (Rust and Rao, 1996). National estimates and 95% confidence intervals (CIs) were computed by using the SAS PROC SURVEYMEANS for interval-level variables and PROC SURVEYFREQ for nominal variables (SAS Institute, 2011). Any nationally weighted estimate that had a coefficient of variation greater than 0.3 was considered unstable and not reported in this paper. Details of the probability weighting for computation of the national estimate and the 95% CI can be found in Sieber et al. (2014).

3. Results

Among the 1265 who completed the full interviews, LHTDs reported a mean age of 48 years (95% CI, 46–49) and had worked an average of 16 years (95% CI, 14–19) as an LHTD. The majority of LHTDs (94%; 95% CI, 91–96%) were male. An estimated 65% (95% CI, 60–69%) of LHTDs were company drivers, 28% (95% CI, 22–34%) were owner-operators who leased to a motor carrier, and 7.4% (95% CI, 3.6–11.3%) were owner-operators who operated under their own authority. Demographic details about the population are available in Sieber et al. (2014).

An estimated 2.6% of LHTDs reported a truck crash in 2010 (Table 1). Since working as an LHTD, 35% of LHTDs reported at least one crash and 12% reported two or more. In the previous 7 days, 24% reported at least one near miss and 12% reported two or more. In the previous 12 months, 17% reported receiving a ticket for a moving violation and 5.3% had been ticketed two or more times. Of those LHTDs who reported a truck crash, 15% were injured in their most recent truck crash.

An estimated 7.3% of LHTDs reported at least one non-crash injury during the previous 12 months. Of these injuries, 64% resulted in days away from work. This result is equivalent to an estimated 4.86% (95% CI, 3.16–6.20%, not shown in Table 1) of LHTDs or 486/10,000 reporting a non-crash injury involving days away from work in the previous 12 months.

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Among the company drivers who had a non-crash injury involving days away from work, 68% did not report the injury to their employer.

LHTDs reported, on average, working 60 (95% CI, 56–65) hours a week and driving 107,700 (95% CI, 101,400–113,900) miles a year. An estimated 66% (95% CI, 62–70%) of LHTDs were paid by the mile for their work and 78% (95% CI, 70–86%) drove alone at work (data not shown in the tables). In the previous 12 months, LHTDs reported having to wait for access to a loading dock (35% often and 50% sometimes); traffic congestion significantly delaying their delivery (17% often and 61% sometimes); being in noncompliance with hours-of-service (HOS) rules (10% often and 27% sometimes); and perceived that their delivery schedules were unrealistically tight (16% often and 58% sometimes) (Table 2). LHTDs reported getting frustrated by other drivers on the road (36% often and 54% sometimes) and by operations at the loading dock (23% often and 49% sometimes). Regarding how drivers felt about being rewarded for their work, 29% felt that their work had never been adequately rewarded. As for driving behaviors, only 86% reported often wearing a seatbelt while driving a truck, 69% reported never driving 10 miles per hour or more over the speed limit, 71% (24% often, 47% sometimes) reported continuing driving despite fatigue, bad weather, or heavy traffic because they needed to deliver or pick up a load at a given time.

As for training, only 62% of LHTDs perceived that they had adequate training at the beginning of their career to safely drive a truck under all road and weather conditions, and 97% perceived that at the time of the interview, they had adequate training to safely handle and secure their cargo (Table 3). Owner operators who leased to a motor carrier and company drivers were asked questions regarding their company safety climate; 82% of them reported that their company had written safety programs and policies, rules, or guidelines regarding workplace safety.

4. Discussion

This NIOSH survey is the first national survey describing LHTD truck crashes, work-related injuries, work environments, safety climate, driver training, attitude, and behaviors in one national profile. The survey suggests that U.S. LHTDs operate in a work environment with a number of potentially adverse factors, including long work hours (60 h weekly compared to 42 weekly for the general U.S. full-time workers) (BLS, 2012), being paid by the mile, perceived unrealistically tight delivery schedules, being forced to wait for access to a loading dock, traffic congestion, and other factors. It is reasonable to hypothesize that the stressful work environment factors, frustrations, unsafe driving behaviors, and the high prevalence of truck crashes and injuries among LHTDs are interconnected. More in depth analyses of the survey data have been planned to examine the associations among truck crashes, truck driver injures, and potential risk factors (Chen et al., 2015).

This survey, for the first time, presents annual, cumulative, and repeated risk of truck crashes among LHTDs in one study: (1) the estimated 2.6% of LHTDs who reported a truck crash in 2010 can be considered as the annual crash rate, (2) the estimated 35% of LHTDs who reported at least one truck crash since working as an LHTD can be considered as the

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cumulative risk of truck crash, and (3) the estimate of 12% of LHTDs who reported two or more crashes since working as a LHTD can be considered as the risk of repeated truck crashes. The estimate of 2.6 crashes per 100 LHTDs annually is equivalent to 24 crashes/100 million vehicle miles traveled (VMT) based on the reported 107,700 average annual VMT per LHTD in this survey, which is lower than the FMCSA's estimate of 95 crashes/100 million VMT for large trucks involved in injury and property damage crashes in 2010 (FMCSA, 2012a). However, there is a difference in the types of trucks between the two estimates. The FMCSA's estimate is for large trucks that are defined as a truck with a gross vehicle weight rating (GVWR) greater than 10,000 pounds. LHTDs drive a heavy truck with a GVWR greater than 25,000 pounds. The crash rate for heavy trucks only is not available in the current literature. Additionally, the estimate of 2.6 crashes/100 LHTDs likely underestimates the true risk of a truck crash among LHTDs in 2010 because the LHTDs who were interviewed in October and November had less than 12 months of work activities to report in 2010.

A striking finding from the survey was that the majority (68%) of non-crash injuries involving days away from work among company drivers were not reported to employers. Workers may not report an injury to their employers because of fear of being fired or disciplined (House of Representatives, 2008). It is also noteworthy that financial incentives for safety have the potential to discourage reporting of incidents/injuries. In the trucking industry, a multi-tiered subcontracting structure, being paid by the miles, and being away from home and company headquarters for days or weeks in a row could arguably exacerbate underreporting of injuries (Rodriguez et al., 2006). Being paid by the mile rather than by the hour might make it possible for LHTDs to take days off work without reporting a non-crash injury to their employers. The overtime exemption under the Fair Labor Standards Act for truck drivers might also have an implication for injury underreporting (DOL, 2009). More studies are needed to examine the issues related to the high percentage of injuries that were not reported among company drivers. The problem of underreporting of injuries among truck drivers is not confined to the United States; research in Australia found that workers under pressure or holding insecure jobs might be reluctant to report their injuries, and that working with an injury is common in the trucking industry (Quinlan and Mayhew, 1999; Mayhew and Quinlan, 2006).

A small percent of LHTDs reported unsafe driving behaviors: often driving 10 miles per hour or more over the speed limit (4.5%), never using a seatbelt while driving a truck (6.0%), and receiving two or more moving violation tickets in the previous 12 months (5.3%). This finding is consistent with a previous study suggesting a relatively small percentage of commercial motor vehicle drivers (10–15%) accounted for a disproportionate percentage of total fleet risk (30–50%) measured by critical incidents, which were defined as significant unsafe driver actions or “near-crashes.” Knipling et al. (2004) suggested that the trucking industry could pilot test behavioral safety management techniques that target the high-risk drivers. These techniques might include performance evaluation and feedback, training and counseling, performance incentives, behavior-based safety, and driver self-management. The effectiveness of various management interventions including both positive rewards and negative discipline need to be evaluated (Knipling et al., 2004).

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Results from the survey suggest that near misses and moving violations are common among LHTDs. Data on near misses and moving violations are useful to study and predict crashes and injuries (Morrow and Crum, 2004; Gilbertson, 2005; Hanowski et al., 2007; Blanco et al., 2008; McKinnon, 2012). Studies (Murray et al., 2006; ATRI, 2011) suggested that moving violations were associated with the risk of truck crashes. Some U.S. companies have used onboard safety monitoring technologies to monitor near misses and provide feedback to truck drivers (Hickman and Hanowski, 2010). Similarly, the U.S. Aviation Safety Reporting System (ASRS) has been collecting confidential, voluntary reports of near misses from pilots, flight attendants, and air traffic controllers since 1976. ASRS data are used to: identify deficiencies and discrepancies in the National Aviation System so that they can be remedied by appropriate authorities, support policy formulation, and strengthen the foundation of aviation human factors safety research (ASRS, 2014). In the trucking industry, efforts could be considered to pilot test near miss reporting systems and evaluate their effectiveness. In addition, forward collision, lane departure warning systems, and roll stability control technologies have been used in the U.S. trucking industry for collision prevention and mitigation (Chen et al., 2004; Hickman et al., 2015).

Findings from this survey also suggest that LHTDs commonly receive what they perceive to be unrealistically tight delivery schedules. An unrealistically tight delivery schedule might be an underlying cause of speeding, driving while fatigued, and noncompliance with HOS rules (McCartt et al., 2008). HOS rules are issued by the FMCSA and govern when and how long a commercial motor vehicle driver may drive (FMCSA, 2014c). NIOSH suggests that companies should schedule work so that drivers can safely make time-sensitive deliveries (NIOSH, 2013). Other intervention measures may include educating drivers, carriers, shippers, and customers/clients about the safety risks of unrealistically tight delivery schedules and the costs of truck crashes; and strengthening HOS regulation enforcement.

The finding that more than one-third (38%) of LHTDs perceived not receiving adequate training at the beginning of their career as an LHTD suggests the need for improvement of entry-level driver training. The projected 11% increase in heavy and tractor-trailer truck driver employment from 1,701,500 in 2012 to 1,894,100 in 2022 (BLS, 2013) makes the need for entry-level training imperative. Federal regulations require that entry-level driver training include instruction addressing only the following four areas: (a) driver qualification requirements including medical certification and general qualifications, (b) HOS and fatigue countermeasures as a means to avoid crashes, (c) driver wellness, and (d) whistleblower protection (FMCSA, 2012b). Training requirements for drivers of longer combination vehicles (LCVs) (i.e., combinations of multiple trailers on a truck-tractor, as compared to the standard 5-axle semi-trailer-trucks with one trailer) are more comprehensive and prescriptive (FMCSA, 2012b).

The self-reported data collected in this survey are subject to possible recall and interviewer bias. To minimize these biases, the survey employed experienced interviewers, standard interview protocols, and survey-specific training. Another potential limitation is social desirability bias. Some drivers may have given the socially and legally appropriate answers to questions about speeding, moving violations, seat belt use, and HOS noncompliance. This bias was minimized by the anonymous nature of this survey. Some questions in the survey

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are subjective and the answers represent drivers' perspective, e.g., the questions regarding training. The survey did not include crashes and non-crash injuries resulting in the injured driver being unable to continue to work as an LHTD; therefore, the estimated rates for truck crashes and injuries involving days away from work likely underestimates the true risks of crash and non-crash injuries among LHTDs. The survey was conducted in the months from October to December; according to DOT's Transportation Service Index, truck activities were increased by 1–3% in November and December compared to the rest of 2010 (DOT, 2013). More discussion on the general strengths and limitations of the NIOSH survey is included in Sieber et al. (2014) and Chen et al. (2015).

5. Conclusions

This NIOSH survey brings to light a number of critical safety issues/patterns that are worth considering for future research and interventions: (1) the high prevalence of truck crashes; more than a third of LHTDs had at least one truck crash and 12% had two or more while working as an LHTD, (2) the majority of lost work day non-crash injuries in company drivers were not reported to employers, (3) driving under schedules they perceived as unrealistically tight and noncompliance with HOS rules were common among LHTDs, and (4) a substantial number of LHTDs perceived that they did not receive adequate entry-level driver training. The survey results provide the needed data for developing research hypotheses and intervention strategies. Surveillance through repeated data collections are needed to track progress and changes in safety among LHTDs overtime.

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References

AAA Foundation for Traffic Safety. [accessed 28.08.15] Drowsy Driving. 2015. https://www.aaafoundation.org/drowsy-driving

Apostolopoulos Y, Sonmez S, Shattell M, Belzer MH. Worksite-induced morbidities of truck drivers in North America: a research meta-analysis of underserved populations. AAOHN J. 2010; 58(7): 285–296. [PubMed: 20608567]

ASRS. [accessed 24.10.14] Aviation Safety Reporting System. 2014. http://asrs.arc.nasa.gov/

ATRI. American Transportation Research Institute; Arlington, VA: 2011. Predicting Truck Crash Involvement: A 2011 Update. http://www.atri-online.org/research/results/ATRICrash_Predictor_One_Pg_Summary_Apr_2011.pdf [accessed 24.10.14]

Belman, D.; Monaco, KA. Sailors of the Concrete Sea: A Portrait of Truck Drivers' Work and Lives. Michigan State University Press; 2004.

Belzer, M.; Rodriguez, D.; Sedo, S. Paying for Safety: An Economic Analysis of the Effect of Compensation on Truck Driver Safety. United States Department of Transportation, Federal Motor Carrier Safety Administration; Washington, DC: 2002. http://www.is.wayne.edu/mbelzer/pubs/PayAndSafety_Report_020910.pdf [accessed 24.10.14]

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Belzer, M. [accessed 24.10.14] The economics of safety: how compensation affects commercial motor vehicle driver safety. Presented to United States House of Representatives Committee on Small Business. 2012. July 11, 2012, http://smallbusiness.house.gov/uploadedfiles/7-11belzer_testimony.pdf

Bigelow, PI.; Betts, D.; Hogg-Johnson, S.; Amick, BC.; Sieber, WK.; Skinner, M.; Jakubicek, M. Health, safety, and wellness of truck drivers in Canada: results of a pilot study. In: Krueger, GP., editor. Research on the Health and Wellness of Commercial Truck and Bus Drivers: Summary of an International Conference. United States Department of Transportation, Federal Motor Carrier Safety Administration, Transportation Research Board; Washington, DC: 2012. p. 95-105.http://onlinepubs.trb.org/onlinepubs/conf/cpw5.pdf [accessed 24.10.14]

Birdsey J, Alterman T, Li J, Petersen MR, Sestito J. Mortality among members of a truck driver trade association. AAOHN J. 2010; 58(11):473–480. [PubMed: 20964270]

Blanco, M.; Hickman, JS.; Olson, RL.; Bocanegra, JL.; Hanowski, RJ.; Nakata, A.; Greening, M.; Madison, P.; Holbrook, GT.; Bowman, D. Investigating Critical Incidents, Driver Restart Period, Sleep Quantity, and Crash Countermeasures in Commercial Operations Using Naturalistic Data Collection: Final Report. Federal Motor Carrier Safety Administration; Washington, DC: 2008. Contract No. DTFH61-01-C-00049, Task Order No. 23

Blincoe L, Seay A, Zaloshnja E, Miller T, Romano E, Luchter S, Spicer R. The Economic Impact of Motor Vehicle Crashes, 2000. 2002 DOT HS 809 446.

BLS. [accessed 24.10.14] Table 603. Persons at Work by Hours Worked: 2010. 2012. http://www.census.gov/compendia/statab/2012/tables/12s0603.pdf

BLS. [accessed 24.10.14] Table 5. Occupations with the Most Job Growth, 2012 and Projected 2022. 2013. http://www.bls.gov/news.release/ecopro.t05.htm

BLS. Occupational Outlook Handbook. U.S Department of Labor, Bureau of Labor Statistics; Washington, DC: 2014a. Heavy and tractor-trailer truck drivers. http://www.bls.gov/ooh/transportation-and-material-moving/heavy-and-tractor-trailer-truck-drivers.htm [accessed 24.10.14]

BLS. U.S Department of Labor, Bureau of Labor Statistics; Washington, DC: 2014b. Nonfatal Occupational Injuries and Illnesses Requiring Days Away from Work, 2013. http://www.bls.gov/news.release/pdf/osh2.pdf [accessed 19.02.15]

BLS. [accessed 19.02.15] Survey of Occupational Injuries and Illnesses (SOII) – Information for Respondents. 2014c. http://www.bls.gov/respondents/iif/

Boyle, LN.; Peng, Y.; Neyens, DM.; Short, J. Mid-America Transportation Center, University of Nebraska-Lincoln; 2010. Safety Climate of Commercial Vehicle Operation. http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1060&context=matcreports [accessed 28.08.15]

Brady JE, Baker SP, Dimaggio C, McCarthy ML, Rebok GW, Li G. Effectiveness of mandatory alcohol testing programs in reducing alcohol involvement in fatal motor carrier crashes. Am J Epidemiol. 2009; 170(6):775–782. [PubMed: 19692328]

Brodie L, Lyndal B, Elias IJ. Heavy vehicle driver fatalities: learnings from fatal road crash investigations in Victoria. Accid Anal Prev. 2009; 41(3):557–564. [PubMed: 19393807]

Bunn TL, Slavova S, Struttmann TW, Browning SR. Sleepiness, fatigue and distraction/inattention as factors for fatal versus nonfatal commercial motor vehicle driver injuries. Accid Anal Prev. 2005; 37:862–869. [PubMed: 15921653]

Bunn TL, Yu L, Slavova S, Bathke A. The effects of semi-truck driver age and gender and the presence of passengers on collisions with other vehicles. Traffic Inj Prev. 2009; 10(3):266–272. [PubMed: 19452368]

Bunn T, Slavova S, Robertson M. Crash and burn? Vehicle, collision, and driver factors that influence motor vehicle collision fires. Accid Anal Prev. 2012; 47:140–145. [PubMed: 22405242]

Bunn T, Slavova S, Robertson M. Motor vehicle injuries among semi truck drivers and sleeper berth passengers. J Saf Res. 2013; 44:51–55.

CDC. [accessed 28.08.15] Distracted Driving. 2015. http://www.cdc.gov/motorvehiclesafety/distracted_driving/

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Chen F, Chen S. Injury severities of truck drivers in single- and multi-vehicle accidents on rural highways. Accid Anal Prev. 2011; 43(5):1677–1688. [PubMed: 21658494]

Chen GX, Collins JW, Sieber WK, Pratt SG, Rodríguez-Acosta RL, Lincoln JE, Birdsey J, Hitchcock TM, Robinson CF. Vital signs: seat belt use among long-haul truck drivers—United Sates, 2010. MMWR64. 2015:217–221.

Chen GX, Amandus HE, Wu N. Occupational fatalities of truck driver and driver/sales workers in the United States, 2003–2008. Am J Ind Med. 2014; 57:800–809. [PubMed: 24811905]

Chen GX, Jenkins EL, Husting L. A comparison of crash patterns in heavy trucks with and without collision warning system technology. SAE 2004. Trans J Commer Veh. 2004; 113(2):360–365.

DOL. [accessed 22.06.15] Fact Sheet #19: The Motor Carrier Exemption under the Fair Labor Standards Act (FLSA). 2009. http://www.dol.gov/whd/regs/compliance/whdfs19.htm

DOT. [accessed 23.02.15] BTS Releases Freight Transportation Services Index (TSI); Freight Shipments Rose 1.2% in May from April. 2013. http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/bts32_13_0.pdf

FMCSA. U.S Department of Transportation, Federal Motor Carrier Safety Administration; Washington, DC: 2007. Large Truck Crash Causation Study. http://www.fmcsa.dot.gov/research-and-analysis/research/large-truck-crash-causation-study [accessed 14.08.14]

FMCSA. FMCSA-RRA-12-023. U.S. Department of Transportation; 2012a. Large Truck and Bus Crash Facts 2010.

FMCSA. U.S Department of Transportation, Federal Motor Carrier Safety Administration; Washington, DC: 2012b. 49 CFR Part 380: Special Training Requirements. http://www.fmcsa.dot.gov/regulations/title49/part/380 [accessed 14.08.14]

FMCSA. [accessed 28.08.15] Part 390 Federal Motor Carrier Safety Regulations; General. 2013. http://www.fmcsa.dot.gov/regulations/title49/section/390.5

FMCSA. Table 4-22. US Department of Transportation, Federal Motor Carrier Safety Administration; Washington, DC: 2014a. Pocket Guide to Large Truck and Bus Statistics. Available at http://www.trb.org/main/blurbs/171674.aspx [accessed 13.02.15]

FMCSA. US Department of Transportation, Federal Motor Carrier Safety Administration; Washington DC: 2014b. Large Truck and Bus Crash Facts 2012. Available at http://www.fmcsa.dot.gov/safety/data-and-statistics/large-truck-and-bus-crash-facts-2012-pdf [accessed 08.04.15]

FMCSA. [accessed 14.08.14] Hours of Service. 2014c. http://www.fmcsa.dot.gov/regulations/hours-of-service

Gilbertson, J. [accessed 14.08.14] Using Near Miss Data as a Safety Improvement Tool. HSW. 2005 Jul 1. http://www.healthandsafetyatwork.com/hsw/content/using-near-miss-data-safety-improvement-tool

Hanowski RJ, Hickman J, Fumero MC, Olson RL, Dingus TA. The sleep of commercial vehicle drivers under the 2003 hours-of-service regulations. Accid Anal Prev. 2007; 39:1140–1145. [PubMed: 17920836]

Hanowski RJ, Hickman JS, Olson RL, Bocanegra J. Evaluating the 2003 revised hours-of-service regulations fortruck drivers: the impact of time-on-task on critical incident risk. Accid Anal Prev. 2009; 41(2):268–275. [PubMed: 19245885]

Heaton K, Browning S, Anderson D. Identifying variables that predict falling asleep at the wheel among long-haul truck drivers. AAOHN J. 2008; 56(9):379–385. [PubMed: 18792612]

Hickman, JS.; Hanowski, RJ. Federal Motor Carrier Safety Administration; Washington, DC: 2010. Evaluating the Safety Benefits of a Low-cost Driving Behavior Management System in Commercial Vehicle Operations: Final Report (Contract No DTMC75-07-D-00006). http://www.google.com/url?sa=t&rct=j&q=&esrc=s&frm=1&source=web&cd=1&ved=0CB0QFjAA&url=http%3A%2F%2Fwww.vehicleservicepros.com%2Fdownload%3Fcontent_id%3D10336417&ei=zlzhU7C8AufNsQTr3YLACQ&usg=AFQjCNGMACg0LGiLvLQAHnZZKjdp2PiiHw [accessed 24.10.14]

Hickman JS, Guo F, Camden MC, Hanowski RJ, Medina A, Mabry JE. Efficacy of roll stability control and lane departure warning systems using carrier-collected data. J Saf Res. 2015; 52:59–63.

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

House of Representatives. A Majority Staff Report by the Committee on Education and Labor. U.S. Government Printing Office; Washington, DC: 2008. Hidden Tragedy: Underreporting of Workplace Injuries and Illnesses. http://www.gpo.gov/fdsys/pkg/CHRG-110hhrg42881/pdf/CHRG-110hhrg42881.pdf [accessed 14.08.14]

Khorashadi A, Niemeier D, Shankar V, Mannering F. Differences in rural and urban driver-injury severities in accidents involving large-trucks: an exploratory analysis. Accid Anal Prev. 2005; 37(5):910–921. [PubMed: 15935320]

Knipling, RR.; Boyle, LN.; Hickman, JS.; York, JS.; Daecher, C.; Olsen, EC.; Prailey, TD. Transportation Research Board; Washington, DC: 2004. Individual Differences and the "High-risk" Commercial Driver Commercial Truck and Bus Safety Synthesis 4. http://onlinepubs.trb.org/onlinepubs/ctbssp/ctbssp_syn_4.pdf [accessed 21.02.15]

Mayhew C, Quinlan M. Economic pressure, multi-tiered subcontracting and occupational health and safety in the Australian long haul trucking industry. Empl Relat. 2006; 28(3):212–229.

McKinnon, RC. Safety Management: Near Miss Identification, Recognition, and Investigation. CRC Press; Boca Raton, FL: 2012.

McCartt AT, Hellinga LA, Solomon MG. Work schedules of long-distance truck drivers before and after 2005 hours-of service rule change. Traffic Inj Prev. 2008; 9(3):201–210. [PubMed: 18570141]

Morrow PC, Crum MR. Antecedents of fatigue, close calls, and crashes among commercial motor-vehicle drivers. J Saf Res. 2004; 35(1):59–69.

Murray, D.; Lantz, B.; Keppler, S. Transportation Research Forum; Fargo, ND: 2006. Predicting Truck Crash Involvement: Developing a Commercial Driver Behavior Model and Requisite Enforcement Countermeasures. Report. http://www.trforum.org/forum/downloads/2006_3A_CrashInvolvement_paper.pdf [accessed 14.08.14]

NHTSA. [accessed 28.08.15] Traffic Safety Facts 2012 Data. DOT HS 812016. 2014. http://www-nrd.nhtsa.dot.gov/Pubs/812016.pdf

NIOSH. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health; Cincinnati, OH: 2002. Quality of Worklife Questionnaire. http://www.cdc.gov/niosh/topics/stress/qwlquest.html [accessed 14.08.14]

Saltzman, GM.; Belzer, MH., editors. NIOSH. Truck Driver Occupational Safety and Health: 2003 Conference Report and Selective Literature Review. U.S Department of Health; Cincinnati, OH: 2007.

NIOSH; 2009. National Occupational Research Agenda (NORA): National Transportation, Warehousing, and Utilities Agenda. http://www.cdc.gov/niosh/nora/comment/agendas/transwareutil/pdfs/TransWareUtilAug [accessed 14.08.14]

NIOSH. [accessed 14.08.14] Work-related Motor Vehicle Crashes: Preventing Injuries to Young Drivers. What Employers Should Know. 2013. http://www.cdc.gov/niosh/docs/2013-153/pdfs/2013-153.pdf

Quinlan M, Mayhew C. Precarious employment and workers' compensation. Int J Law Psychiatry. 1999; 22(5-6):491–520. [PubMed: 10637755]

Quinlan, M.; Wright, L. National Transport Commission; Melbourne, Australia: 2008. Remuneration and Safety in the Australian Heavy Vehicle Industry: A Review Undertaken for the National Transport Commission. http://www.rsrt.gov.au/default/assets/File/exhibits_draftRSRO/TWU23.pdf [accessed 14.08.14]

Rodriguez DA, Targa F, Belzer MH. Pay incentives and truck driver safety: a case study. Ind Labor Relat Rev. 2006; 59(2):205–225.

Rust KF, Rao JNK. Variance estimation for complex surveys using replication techniques. Stat Methods Med Res. 1996; 5(3):283–310. [PubMed: 8931197]

Sabbagh-Ehrlich S, Friedman L, Richter ED. Working conditions and fatigue in professional truck drivers at Israeli ports. Inj Prev. 2005; 11:110–114. [PubMed: 15805441]

SAS Institute. Statistical Analysis System V 9.2. SAS Institute Inc.; Cary, NC: 2011.

Sieber WK, Robinson CF, Birdsey J, Chen GX, Hitchcock EM, Lincoln JE, Nakata A, Sweeney MH. Obesity and other risk factors: the national survey of U.S. long-haul truck driver health and injury. Am J Ind Med. 2014; 57(6):615–626. [PubMed: 24390804]

Author Manuscript Author Manuscript Author Manuscript Author Manuscript

Stevenson M, Sharwood LN, Wong K, Elkington J, Meuleners L, Ivers RQ, Grunstein RR, Williamson A, Haworth N, Norton R. The heavy vehicle study: a case-control study investigating risk factors for crash in long distance heavy vehicle drivers in Australia. BMC Public Health. 2010; 10:162. http://www.biomedcentral.com/content/pdf/1471-2458-10-162.pdf. [PubMed: 20338064]

Zohar D. Thirty years of safety climate research: reflections and future directions. Accid Anal Prev. 2010; 42:1517–1522. [PubMed: 20538108]

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Table 1

Truck crashes, near misses, moving violations, and injuries, National Survey of U.S. Long-Haul Truck Driver (LHTD) Health and Injuries 2010.

	Number of LHTDs responding	Weighted national estimate[a] (%)	95% confidence interval	
			LB	UB
In your career as a truck driver, have you ever been in a DOT recordable crash[b]?	436/1263	35	31	39
If yes, how many of these crashes have you had?				
1	285/1263	23	18	27
2 or more	151/1263	12	8	16
As a result of your most recent crash, did you suffer any injuries that required immediate medical attention by a doctor, nurse, or other health professional?	71/436[c]	15	9	21
Did you missed any workdays due to this injury?	62/71[d]	79	64	94
Crash occurred in 2010	38/1263	2.6	2.2	3.0
Since last [the day of the week that was 7 days ago], have you had “a near miss” that made you feel lucky not to have been in a crash?	308/1263	24	19	28
How many times since last [the day of the week that was 7 days ago] have you had “a near miss”?				
1	163/1263	12	8	16
2 or more	145/1263	12	10	14
How many moving violations have you received while on duty in the last 12 months?				
1	168/1261	12	9	15
2 or more	81/1261	5.3	3.0	7.6
During the last 12 months, did you receive any non-crash injuries on your job for which you visited a doctor or other health professional?	95/1263	7.3	6.2	8.5
Which of the following best describe the types of injury or injuries you received. Was it a…				
…Sprain or strain?	58/95[e]	59	48	70
…Fracture?	13/95[e]	16	8	25
…Something else?	43/95[e]	NR[f]	NR	NR
Did you miss any work days due to this injury?	50/95[e]	64	41	87
Number of company drivers who had a lost work day non-crash injury but did not report the injury to employer	28/40[g]	68	41	94

[a] Weighted national estimates were computed by using all non-missing survey responses.

[b] A Department of Transportation (DOT) recordable crash is a truck crash on a public road in intrastate or interstate commerce that resulted in one of the following: a fatality, an injury requiring immediate treatment away from the scene of the accident, or disabling damage to the vehicle.

[c] The denominator is the number of LHTDs who ever had a truck crash.

[d] The denominator is the number of LHTDs who were injured in their most recent truck crash.

[e] The denominator is the number of LHTDs who had at least one non-crash injury in the previous 12 months.

[f] National estimate is not presented because it consists of several injury categories that all have weighted estimates with coefficients of variation greaterthan 0.3.

[g] The denominator is the number of company LHTDs who had a non-crash injury involving days away from work in the previous 12 months.

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Table 2

Work environments, driver training, attitudes, and behaviors, the National Survey of U.S. Long-Haul Truck Driver (LHTD) Health and Injury 2010.

	Number of LHTDs responding	Often (%[a])	Some-times (%)	Never(%)
Work environments				
How often do you load and unload your truck at work?	1263	17	16	67
In your driving experience over the previous 12 months, how often do the following situations occur?				
You must deliver or pick up a load at a given time.	1263	72	21	6
The dispatcher works with you get you home as scheduled.	1263	63	24	10
You arrive on time but are forced to wait to enter a dock.	1263	35	50	12
Traffic congestion delays your deliveries significantly.	1263	17	61	22
The time you are allotted for loading and unloading is unrealistically tight.	1263	16	42	38
You receive an unrealistically tight delivery schedule.	1263	16	58	26
The hours-of-service rules are violated.	1263	10	27	63
Your delivery is later than scheduled.	1263	8.3	45	46
Behaviors				
How often do you continue to drive despite fatigue, bad weather, or heavy traffic because you must deliver or pick up a load at a given time?	1263	24	47	29
How often do you wear a seatbelt?	1263	86	7.8	6.0
How often do you drive 10 miles per hour or more over the speed limit?	1263	4.5	26	69
Job satisfaction and frustration				
How often do you get frustrated by operations at the loading dock?	1263	23	49	27
How often do you get frustrated by other drivers on the road?	1263	36	54	10
How often do you feel your work has been adequately rewarded?	1263	36	34	30

[a] Weighted national estimates were computed by using all non-missing survey responses.

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Table 3

Driver training and safety climate, the National Survey of U.S. Long-Haul Truck Drivers (LHTDs) Health and Injury 2010.

	Number of LHTDs responding	Weighted national estimate[a] (%)	95% confidence interval	
			LB	UB
Training				
At the beginning of you carrier as a truck driver, did you received enough training to drive truck safely under all road and weather conditions?	792/1263	62	58	66
Do you now have enough training to safely handle and secure your cargo?	1226/1263	97	96	98
Safety climate				
Does the company have safety programs, written policies, rules, or guidelines regarding workplace safety?	963/1162[b]	82	80	84
Does the company offer safety awards/incentives?	626/1162	56	49	64
The safety of workers is a high priority with management where I work				
Strongly agree	464/1162	41	38	44
Agree	525/1162	44	39	49
Disagree	115/1162	10	7	12
Strongly disagree	53/1162	5	1	8
There are no significant compromises or shortcuts taken when worker safety is at stake				
Strongly agree	429/1162	40	35	44
Agree	529/1162	44	39	49
Disagree	146/1162	12	9	15
Strongly disagree	50/1162	4	1	7
Where I work, employees and management work together to ensure the safest possible working conditions				
Strongly agree	327/1162	27	22	32
Agree	592/1162	53	46	59
Disagree	162/1162	15	11	18
Strongly disagree	75/1162	5	2	9

[a] Weighted national estimates were computed by using all non-missing survey responses.

[b] Only company drivers and owner operators who leased to a motor carrier were asked the safety climate questions.